



## Stack Emission Test Protocol

Prepared for:  
Madison-Kipp Corporation

Madison-Kipp Corporation  
Atwood and Fair Oaks Facilities  
Madison, Wisconsin

April 2014

# Table of Contents

---

1.	General Information.....	1
1.1	Background.....	1
1.2	Scope of Work.....	1
1.3	Testing Schedule.....	2
2.	Sampling and Analytical Procedure .....	3
2.1	Sampling Plan.....	3
2.2	Operational Parameters.....	4
2.3	Testing and Analytical Methods .....	4
2.3.1	Determination of Sample Point Locations by USEPA Method 1 .....	5
2.3.2	Volumetric Flow Rate Determination by USEPA Method 2.....	5
2.3.3	CO <sub>2</sub> and O <sub>2</sub> Determination by USEPA Method 3 .....	5
2.3.4	Filterable PM <sub>10</sub> and PM <sub>2.5</sub> Determination by USEPA Method 201A (As Revised December, 2010) .....	6
2.3.5	Condensable PM Determination by USEPA Method 202 (As Revised December, 2010) .....	6
2.3.6	Visible Emissions Determination by USEPA Method 9 .....	6
2.3.7	Hydrogen Halide and Halogen Determination by USEPA Method 26A .....	7
2.4	Quality Assurance Procedures.....	7

# Section 1

## General Information

---

### 1.1 Background

Madison-Kipp Corporation (Kipp) operates two aluminum die casting facilities that are located on contiguous properties on the East side of Madison. The facility located at 2824 Atwood Avenue (Atwood) operates two gas-fired reverberatory melt furnaces along with up to 17 die cast machines. Aluminum is melted, alloyed, demagged (chlorine gas is used to remove magnesium), drossed and degassed before being cast in aluminum die casters. The facility located at 166 S. Fair Oaks Street (Fair Oaks) operates one gas-fired reverberatory melt furnace and up to seven die cast machines. There is no chlorine used at Fair Oaks. All of the melt furnaces are stack-vented.

Kipp received a letter from the United States Environmental Protection Agency (USEPA) Region V dated February 10, 2014, requesting emission stack testing for the aluminum melt furnaces at the Atwood and Fair Oaks facilities under the authority of Section 114 of the Clean Air Act. This protocol has been prepared in response to that request.

### 1.2 Scope of Work

Based on the information requested in the letter received from the Agency and subsequent discussions between the Agency and Kipp, the following scope of testing was agreed upon for the stack emission testing:

#### **Atwood Facility**

- Test one of the melt furnaces for the following pollutants:
  - Particulate Matter (PM)
  - Ten-micron Particulate (PM<sub>10</sub>)
  - Visible Emissions (Opacity)
  - Hydrogen Chloride (HCl )
  - Chlorine (Cl<sub>2</sub>)

## **Fair Oaks Facility**

- Test the melt furnace for the following pollutants:
  - Particulate Matter (PM)
  - Ten-micron Particulate (PM<sub>10</sub>)
  - Visible Emissions (Opacity)

The USEPA originally requested that dioxin and 2.5-micron particulate (PM<sub>2.5</sub>) be included in the testing regimen; however, the USEPA later informed Kipp that testing of these pollutants was not required.

## **1.3 Testing Schedule**

The stack emission testing has been scheduled to take place over the course of two consecutive weekends in order to minimize the interruption to the regular production schedule. The Fair Oaks stack testing will take place on Saturday, May 10, 2014, and the Atwood testing will take place on Friday, May 16, and Saturday, May 17, 2014.

## Section 2

# Sampling and Analytical Procedure

---

### 2.1 Sampling Plan

The following sampling plans have been developed to represent the worst-case operating scenarios for each pollutant while also being able to maintain consistent conditions throughout the test periods.

#### **PM, PM10, and Opacity (Atwood and Fair Oaks)**

During the test, the furnace will be set up to operate at approximately 80% (or greater) of the permitted capacity of 4.0 tons per hour. The furnace will melt primarily scrap, with supplemental sows to achieve the desired capacity. The scrap used will have appropriate magnesium content so that no chlorine is anticipated to be utilized during the test. Chlorine usage on the furnace is primarily associated with the introduction of sows that have elevated magnesium content. However, the highest particulate emission rate is expected to be associated with the melting of scrap. Therefore, the facility will maximize the usage of scrap on the furnaces. When large percentages of scrap are melted, adjustment of the magnesium content via chlorine addition is generally not required as the scrap generally has a magnesium content nearly the same as that specified for the molten aluminum. There will be three (3) 90-minute test runs.

#### **Chlorine/HCl (Atwood only)**

For the chlorine/HCl testing, the metal bath will be prepared prior to the beginning of the stack test. The bath will be maintained throughout the duration of the test without the addition or removal of metal from the bath. Chlorine will be injected at a rate of 30 pounds per hour during the test runs. There will be three (3), 60-minute test runs.

Chlorine is used to remove magnesium from the aluminum to achieve the target magnesium content in the parts cast. Since the last emission testing was completed in 2003, the target magnesium content has evolved on an industry-wide basis such that the allowable magnesium content is on the order of three times higher than in 2003. In order to maximize the usage of chlorine during the test run, the molten bath must be maintained at a magnesium content that is higher than normal. This is difficult to achieve when either molten metal is being removed from the furnace or scrap is being added to the furnace. Therefore, Kipp will conduct this test run without the addition or removal of metal from the furnace so that the magnesium content can be maintained and the flow of chlorine can be maximized. Chlorine will be added at the rate of 30 pounds per hour, as long as the magnesium content is maintained above the target

level. If the magnesium content drops below this level, the chlorine will be turned off. Note that chlorine and HCl emissions are permitted and reported on a pound of emission per pound chlorine basis (rather than pound emission per ton melted basis) and the emission test results will therefore be normalized regardless of the amount of chlorine added during the test.

**Emission Testing Matrix**

Test Location	Emission Point	Pollutant	Number of Runs	Sample Run Time	USEPA Methods
Atwood, Fair Oaks	Stack	PM/PM <sub>10</sub>	3	90	Methods 201A, 202
Atwood, Fair Oaks	Stack	Opacity	3	60	Method 9
Atwood Only	Stack	Chlorine/HCl	3	60	Method 26A
Atwood, Fair Oaks	Stack	Volumetric flow	Each test	Each test	Methods 1, 2
Atwood, Fair Oaks	Stack	O <sub>2</sub> , CO <sub>2</sub>	Each test	Each test	Method 3

## 2.2 Operational Parameters

The following operational parameters will be monitored:

- Furnace level
- Metal temperature
- Chlorine flow rate (when applicable)
- Chlorine pump motor amperage (when applicable)
- Magnesium content
- Metal melt rate (when applicable)

## 2.3 Testing and Analytical Methods

Testing, sampling, analytical, and calibration procedures used for this test program will be performed in accordance with the methods presented in the following sections. Where applicable, the Quality Assurance Handbook for Air Pollution Measurement Systems, Volume III, Stationary Source Specific Methods, USEPA 600/R-94/038c, September 1994 is used to supplement procedures.

### 2.3.1 Determination of Sample Point Locations by USEPA Method 1

This method is applicable to gas streams flowing in ducts, stacks, and flues and is designed to aid in the representative measurement of pollutant emissions and/or total volumetric flow rates from stationary sources. In order to qualify as an acceptable sample location, it must be located at a position at least two stack or duct equivalent diameters downstream and a half equivalent diameter upstream from any flow disturbance.

The cross-section of the measurement site is divided into a number of equal areas, and the traverse points are then located in the center of these areas. The minimum number of points are determined from either Figure 1-1 (particulate) or Figure 1-2 (non-particulate) of USEPA Method 1.

### 2.3.2 Volumetric Flow Rate Determination by USEPA Method 2

This method is applicable for the determination of the average velocity and the volumetric flow rate of a gas stream.

The gas velocity head ( $\Delta P$ ) and temperature is measured at traverse points defined by USEPA Method 1. The velocity head is measured with a Type S (Staustscheibe or reverse type) pitot tube and oil-filled manometer; and the gas temperature is measured with a Type K thermocouple. The average gas velocity in the flue is calculated based on: the gas density (as determined by USEPA Methods 3 and 4); the flue gas pressure; the average of the square roots of the velocity heads at each traverse point, and the average flue gas temperature.

### 2.3.3 CO<sub>2</sub> and O<sub>2</sub> Determination by USEPA Method 3

This method is applicable for the determination of CO<sub>2</sub> and O<sub>2</sub> concentrations and dry molecular weight of a sample from an effluent gas stream of a fossil-fuel combustion process or other process.

A gas sample is extracted from a stack by one of the following methods: 1) single-point, grab sampling; 2) single-point, integrated sampling; or 3) multi-point, integrated sampling. The gas sample are analyzed for percent CO<sub>2</sub> and percent O<sub>2</sub> using either an Orsat or Fyrite gas analyzer.

#### **2.3.4 Filterable PM<sub>10</sub> and PM<sub>2.5</sub> Determination by USEPA Method 201A (As Revised December, 2010)**

This method applies to the in-stack measurement of filterable Particulate Matter (PM) emissions equal to or less than an aerodynamic diameter of nominally 10 µm (PM<sub>10</sub>) from stationary sources. The EPA defines primary PM as particulate that enters the atmosphere directly from a source and is composed of two components: filterable PM and condensable PM. If the filtration temperature exceeds 30°C (85°F), and total primary PM must be measured, then this method must be combined with Method 202, 40 CFR 60 Appendix M. If the filtration temperature never exceeds 30°C (85°F), then Method 202 is not required to measure total primary PM.

Flue gas is withdrawn from the source at a predetermined constant flow rate through an in-stack PM<sub>10</sub> cyclone sizing device and filter. The mass of the size fraction is determined gravimetrically after the removal of uncombined water. USEPA Methods 2-4 are performed concurrently as an integral part of these determinations.

#### **2.3.5 Condensable PM Determination by USEPA Method 202 (As Revised December, 2010)**

This method is applicable for the determination of condensable particulate matter (CPM) from stationary sources. CPM is measured in the emissions after removal from the stack and after passing through a filter.

The CPM is collected in dry impingers after filterable particulate material has been collected on filters maintained above 30°C (85° F) using Method 5 or 17 (Appendix A, 40 CFR 60) or 201A (Appendix M, 40 CFR 51) type sampling train. The sample train includes a Method 23 type condenser capable of cooling the stack gas to less than 85°F, followed by a water dropout impinger. One modified Greenburg Smith impinger and a CPM filter follow the water dropout impinger. The impinger contents are immediately purged after the run with nitrogen (N<sub>2</sub>) to remove dissolved sulfur dioxide. The impinger solution is then extracted with hexane, and the CPM filter is extracted with water and hexane. The organic and aqueous fractions are then taken to dryness and the residues weighed. A correction, if necessary, is made for any ammonia present due to laboratory analysis procedures. The total of all fractions represents the CPM.

#### **2.3.6 Visible Emissions Determination by USEPA Method 9**

This method is applicable for the determination of the opacity of emissions from stationary sources pursuant to § 60.11(b) and for visually determining opacity of emissions.



Opacity observations are made by a qualified observer. Observations are made at the point of greatest opacity in the portion of the plume where condensed water vapor is not present. Observations are made at 15-second intervals for the duration of the test period.

### 2.3.7 Hydrogen Halide and Halogen Determination by USEPA Method 26A

This method is applicable for determining emissions of hydrogen halides (HCl, HBr, and HF) and halogens (Cl<sub>2</sub> and Br<sub>2</sub>) from stationary sources when specified by the applicable subpart. This method collects the emission sample isokinetically and is therefore particularly suited for sampling at sources, such as those controlled by wet scrubbers, emitting acid particulate matter (*e.g.*, hydrogen halides dissolved in water droplets). USEPA Methods 2-4 were performed concurrently with, and as an integral part, of these determinations.

Flue gas will be withdrawn isokinetically from the source at traverse points determined per USEPA Method 1 through a nozzle; probe liner, filter and a series of impingers. The probe liner and filter will be maintained at a temperature of greater than 120°C (248°F) or such other temperature as specified by an applicable subpart of the standards or approved by the Administrator for a particular application. Acidic and alkaline absorbing solutions in the impingers will collect the gaseous hydrogen halides and halogens, respectively. The impinger contents will be analyzed by ion chromatography (IC).

## 2.4 Quality Assurance Procedures

TRC integrates our Quality Management System (QMS) into every aspect of our testing service. We follow the procedures specified in current published versions of the test Method(s) referenced in this report. Any modifications or deviations are specifically identified in the body of the report. We routinely participate in independent, third party audits of our activities, and maintain:

- ISO 9001:2000 accreditation of our QMS;
- Louisiana Environmental Lab Accreditation Program (LELAP) accreditation; and
- Preliminary accreditation from the Stack Testing Accreditation Council (STAC) that our operations conform with the requirements of ASTM D 7036-04.

These accreditations demonstrate that our systems for training, equipment maintenance and calibration, document control and project management will fully ensure that project objectives are achieved in a timely and efficient manner with a strict commitment to quality.

All calibrations are performed in accordance with the test Method(s) identified in this protocol. If a Method allows for more than one calibration approach, or if approved alternatives are available, the calibration documentation in the appendices specifies which approach is used. All measurement devices are calibrated or verified at set intervals against standards traceable to the National Institute of Standards and Technology (NIST). NIST traceability information is available upon request.